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CASE REPORT

PAST, a novel solution for crossing another wire in the severely dissected peripheral artery

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ABSTRACT

The most prevalent symptom of lower limb artery occlusions is intermittent claudication. The most commonly used technique to treat symptomatic patients is balloon dilatation of the occlusive plaque. Balloon dilatation of the lesion may cause dissection. The dissected artery wiring is a challenging scene. First, we can implant a stent in the dissection and then use it to cross the sealed artery. Additionally, we can use dual lumen catheters or dual lumen balloon catheters. But sometimes, angiography labs do not have these modern devices. In the present case, we came up with a solution and successfully finished the procedure by using a balloon catheter to transfer the second guidewire, which cannot pass through the dissected lesion. We named the technique Peripheral Artery Sidecar Technique (PAST).

Keywords: Angioplasty, dissection, guidewire, peripheral artery

INTRODUCTION

Occlusive disorders of the lower extremity peripheral arteries most frequently occur in the superior femoral arteries (SFA) (1). The most often employed technique for treating patients is balloon dilatation of the occlusive plaque (2). However, balloon dilatation causes lumen enlargement due to the dissection and compression of the plaque (2,3). It takes quite a bit of work to insert a new guidewire into the dissected vascular segment because the wire frequently passes through the subintima. In this situation, the best course of action may be to secure the dissection flap to the vascular wall using long-term balloon dilatation or stent implantation before advancing the guidewire, but with the risk of stent thrombosis (4). Dual-lumen catheters may be another option for advancing a guidewire from the dissected artery (5). We would like to share a case where we came up with an alternative solution and successfully finished the procedure by using a balloon catheter to transfer the second guidewire, which cannot pass through the dissected lesion, Peripheral Artery Sidecar Technique (PAST).

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CASE PRESENTATION

We admitted a 54-year-old male patient who complained of intermittent claudication in the calf region. The lower extremity arterial Doppler ultrasound revealed monophasic flow in the right peroneal artery (PA), arteria tibialis anterior (ATA), and arteria tibialis posterior (ATP), along with total occlusion of the SFA. We planned a lower extremity peripheral angiography (PAG). It was observed that there was chronic total occlusion of the right SFA distal, and the PTA and peroneal artery were filled with well-developed collateral circulation originating from the deep femoral artery and SFA (Figure 1a, Video 1 and Video 2). Additionally, the ATA was weakly filled with the peroneal artery and collateral vessels originating from the PTA midregion (Figure 1b, Video 2). We parked a 7F 90 cm sheath (Flexor Shuttle-SL introducer guiding sheath, Cook, United States) in the right SFA, along with a 6F right Judkins diagnostic catheter. The 0.035'' NAVICROSS® Support Catheter (Terumo, Tokyo, Japan), along with a 0.035'' hydrophilic wire (Glidewire Advantage, Terumo, Tokyo, Japan), attempted to enter the PTA. However, the wire advanced subintimally and was unable to traverse into the distal true lumen. We also encountered failures with the Hi-Torque Winn 40 (Abbott, United States), Halberd (Asahi Intecc, Nagoya, Japan), and AstatoXS40 (Asahi Intecc, Nagoya, Japan) wires (Figure 2). The decision was made to perform a retrograde SFA occlusion by puncturing the PTA. The PTA was punctured with a 0.018'' Gladius (Asahi Intecc, Nagoya, Japan), and the distal cap was engaged with a 3.0x120 mm peripheral balloon (Sterling, Boston Scientific, USA) support (Figure 3a, Video 3). As the Gladius failed to progress, we advanced the Halberd wire (Asahi Intecc, Nagoya, Japan) with balloon support, ultimately passing the SFA true lumen (Figure 3b). The same 3.0x120 mm balloon dilated the lesion with pressures between 8 and 14 atm (Figure 3c). Instead of using the Halberd wire, we sent a 300 cm 0.014'' mm floppy wire (Choice Floppy Guidewire, Boston Scientific, USA) through the balloon that entered the SFA. We aimed to enter the 7F sheath in the SFA, externalize the wire from the left CFA, and execute the procedure in an antegrade manner (Figure 3D, Video 4). A 4.0x120 mm peripheral balloon (Sterling, Boston Scientific, USA) at 6-8 atm and a 5.0x150 mm peripheral balloon (Mustang, Boston Scientific, USA) at 6-8 atm were applied to the lesion over 0.014'' wires via the antegrade route (Figure 4a). Following balloon dilatation, the distal SFA had an optimal opening but a short dissecting aneurysmatic lesion that did not disrupt the flow (Figure 4b, Video 5). Once again, we observed that the ostium of the ATA, previously only weakly filled with collaterals from the distal, was now fully filled (Figure 4c). We planned to pass another

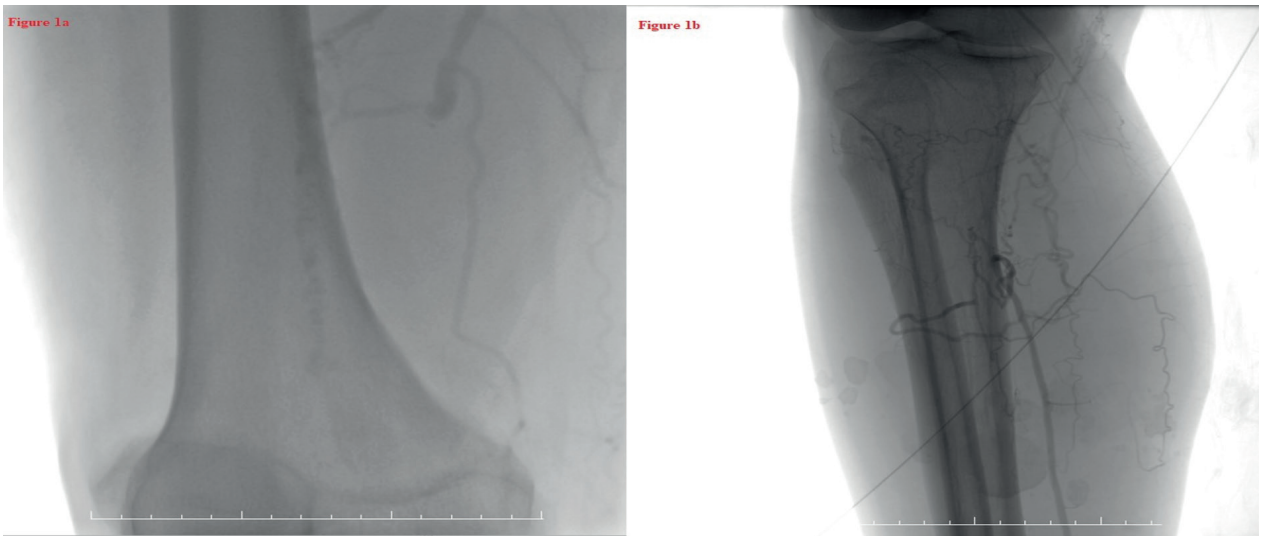

Figure 1. a: Chronic total occlusion of the right superficial femoral artery. **b:** Collateral filling of the right posterior tibial artery and peroneal artery, also weak filling of the right anterior tibial artery.

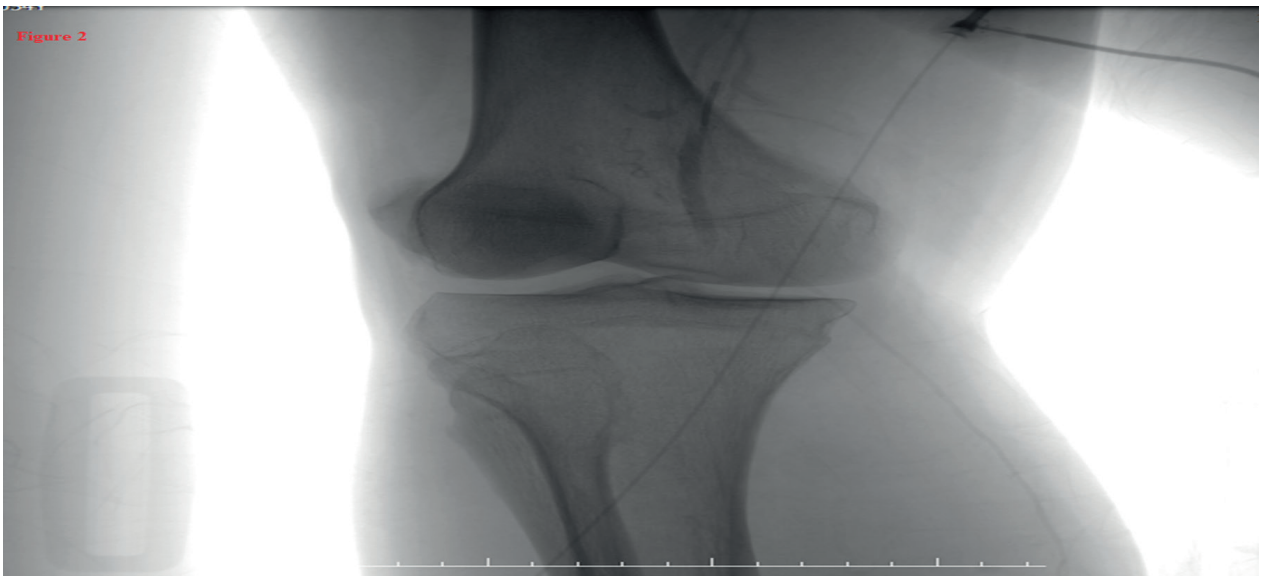

Figure 2. Dissected superior femoral artery with contrast staining of the false lumen.

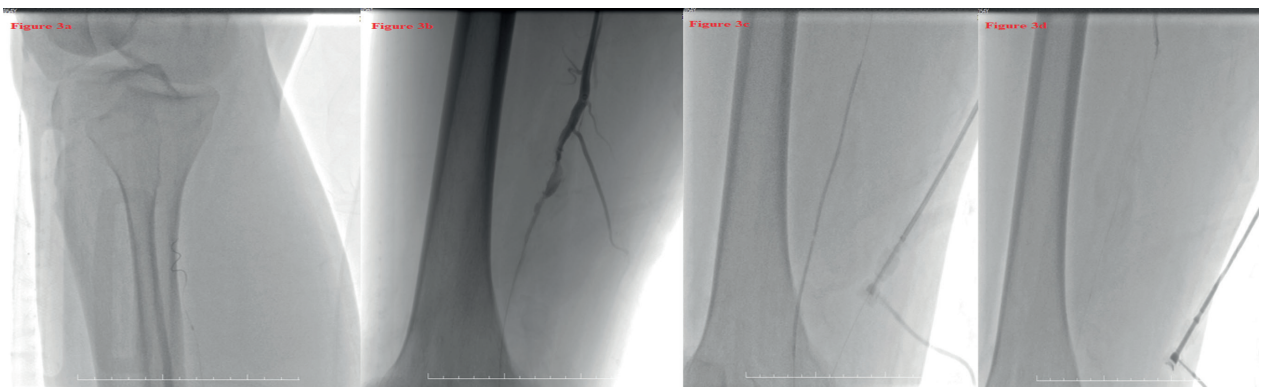

Figure 3. a: After the puncture of the distal posterior tibial artery, 0.018'' Gladius wire advanced and the distal cap was engaged with 3.0x120 mm peripheral balloon. **b:** Halberd wire was passed into the SFA true lumen. **c:** 3.0x120 mm balloon dilatated the lesion. **d:** A 300 cm 0.014'' mm floppy wire was sent instead of the Halberd wire through the balloon entering the SFA.

wire through the total occlusion in the ATA. However, we were unable to pass a second wire through the dissected lesion in the SFA. Since the angiography lab did not have a peripheral vascular dual-lumen catheter, we inflated the 4.0x120 mm balloon with air. This balloon had been used before to widen the SFA and PA. Next, we inflated the balloon to 4 atm using saline. A 23-gauge needle punctured the balloon at its proximal end. We gently inserted the needle into the balloon, but did not puncture the distal end. We inserted a Fielder FC guidewire (Asahi Intecc, Nagoya, Japan) and pushed it forward until the tip of the balloon. We held both the balloon and the inserted wire, then gently removed them from the needle. On the main guidewire, we held onto both the balloon and the wire and pushed both forward as a unit. We advanced the balloon as far distal as possible through the lesion, retracted the Fielder FC (Asahi Intecc, Nagoya, Japan) from the balloon,

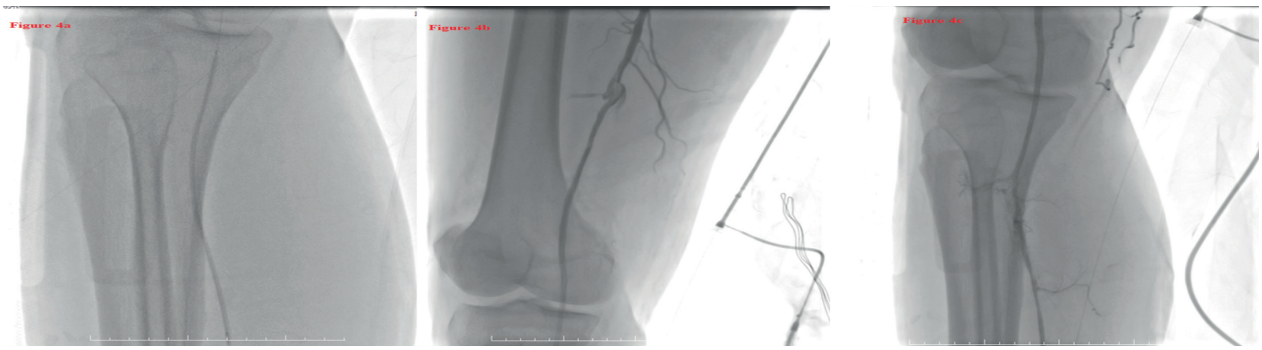

Figure 4. a: 4.0x120 mm and 5.0x150 mm peripheral balloons dilatation applied to the lesion over 0.014'' wires via antegrade route. **b:** After balloon dilatation, the lesion in the distal SFA had an optimal opening, but a short dissecting aneurysmatic lesion that did not disrupt the flow. **c:** The ostium of the ATA, which was only weakly filled with collaterals from the distal before, was filled.

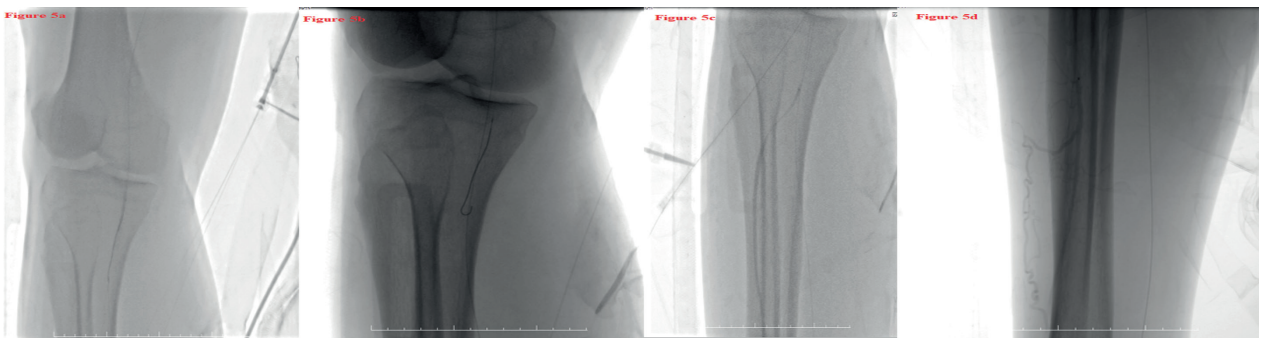

Figure 5. a: The sidecar balloon catheter transported the second wire through the dissected segment. **b:** The second wire was at the level of the ATA ostium. **c:** The ATA was dilated with a 3.0x150 mm peripheral balloon catheter. **d:** The final view of the ATA.

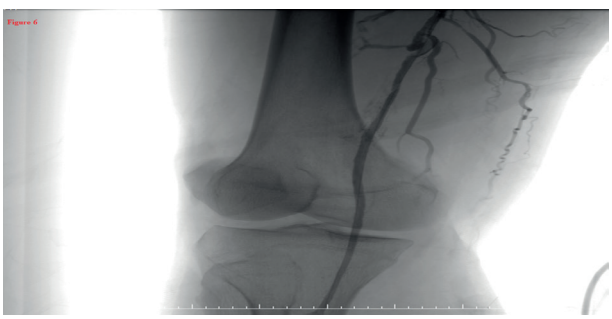

Figure 6. The dissected lesion in SFA was short and the flow was not disturbed.

and then advanced it again outside, parallel to the balloon (Figures 5a and 5b, Video 6). We removed the balloon catheter from the coronary artery. The Fielder FC wire passed the total occlusion lesion in the ATA and reached the ADP. The ATA was dilated at 12-16 atm with a 3.0x150 mm peripheral balloon catheter (Sterling, Boston Scientific, USA) (Figure 5c). We observed that the ATA lesion opened optimally, and the ADP began to fill antegradely (Figure 5d). We planned a medical follow-up because the dissected lesion in the SFA was short and the flow was not disrupted, leading us to terminate the procedure (Figure 6).

DISCUSSION

Occlusive disorders of the lower extremity peripheral arteries occur most frequently in the superior femoral arteries (SFA) (1). The most often employed technique for treating patients is balloon dilatation of the occlusive plaque (2). However, the dissection and compression of the plaque are the causes of the lumen enlargement brought on by balloon dilatation (2,3). It takes quite a bit of work to insert a new guidewire into the dissected vascular segment because the wire frequently passes through the subintima. It might be best to use long-term balloon dilatation or stent implantation to attach the dissection flap to the vascular wall before moving the guidewire forward, but there is a chance of stent thrombosis (4). Dual-lumen catheters may be another option for advancing a guidewire from the dissected artery (5). In our case, after SFA/PA balloon dilatation, we observed ATA antegrade filling, which was not visible before. However, since the SFA/PA occlusion crosses retrogradely from the PTA, withdrawing this wire and directing it to the ATA may not be appropriate. The complication occurs when the lesion forms a dissecting aneurysmatic lesion, which then passes through another guidewire and crosses the ATA occlusion, potentially losing the distal flow due to the lengthening of the dissection flap to the trifurcation point. As a result, we devised a method for passing a second guidewire through the dissected lumen from the side of the balloon catheter. We then send this guidewire over the externalized wire, which retrogrades the occluded segment. We named that technique PAST. During our literature research, we discovered a case report (6) applied this technique to coronary arteries. However, the literature does not demonstrate such an application in peripheral arteries. We present the first case in the literature that applies this technique to peripheral arteries. The PAST can be free, especially when a used balloon is recycled. The absence of the over-the-wire (OTW) portion of traditional dual-lumen catheters, which makes removal easier when the second guidewire is inserted, is a benefit. The PAST allows the use of any balloon size.

The PAST may not be as effective in the long, severely calcified, and tight CTO lesions (6). In comparison to a dedicated dual-lumen catheter, the steerability and directability of the second guidewire may be constrained. When the balloon catheter is inside the coronary artery, it is best to avoid attaching the cotransporter's hub to the indeflator to prevent air embolization. The crossing profile remains unchanged when advancing and retrieving the balloon, thereby reducing the risk of balloon retrieval failure in calcified lesions. The distal transfer may result in the loss of the wire. In this scenario, we can either remove the cotransporter, as the second wire has sufficiently migrated distally, or we must remove the wire first, followed by the cotransporter, thereby requiring a new round of the procedure.

The PAST presents a simple and inexpensive solution whenever a dual-lumen microcatheter or dual-lumen balloon is unavailable or inapplicable.

Ethical approval

Written informed consent was obtained from the participants.

Author contribution

Surgical and Medical Practices: EA, ID; Concept: EA; Design: EA, YG; Data Collection or Processing: EA, TD, EO; Analysis or Interpretation: EA, YG, IAI; Literature Search: EA; Writing: EA, SI. All authors reviewed the results and approved the final version of the article.

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Conflict of interest

The authors declare that there is no conflict of interest.

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